



Michigan DOT Connected Vehicles

Michigan Traffic Safety Summit 2015

March 24th, 2015

PRESENTATION OVERVIEW

- Toward Zero Deaths Initiative
- Connected Vehicles (CV) Overview
- USDOT Safety Pilot Model Deployment
- MDOT Connected Vehicle Projects
- MDOT Smart Corridor
 - Location
 - Applications
- MDOT AV Support

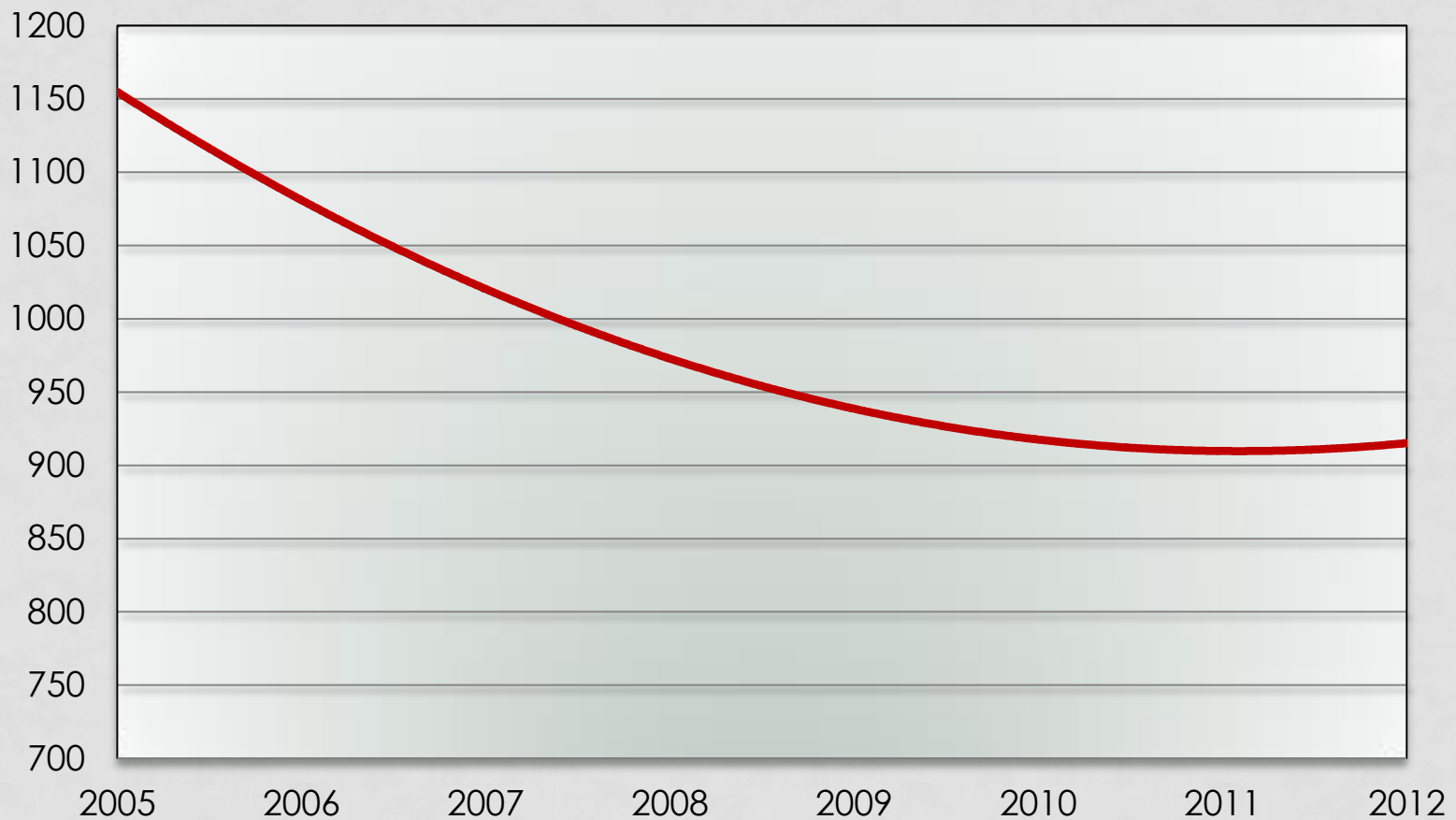




Toward Zero Deaths[®]

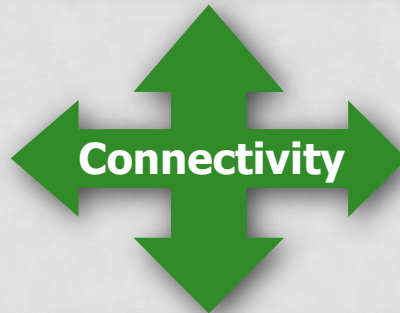
National Strategy on Highway Safety

Michigan Traffic Fatality Trends



CONNECTED VEHICLES

Drivers/Operators



Vehicles and Fleets

Infrastructure

Wireless Devices

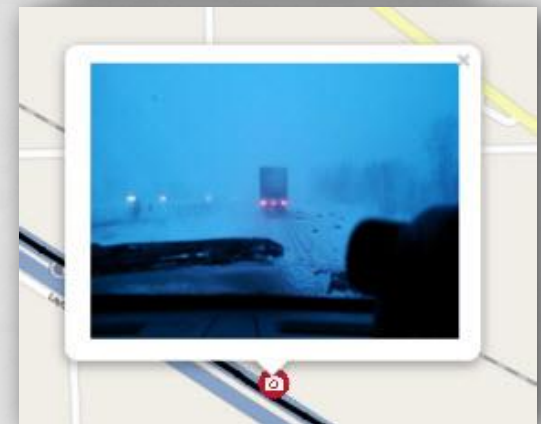
USDOT SAFETY PILOT MODEL DEPLOYMENT

- Determine effectiveness of safety technology and applications
- Support NHTSA decision-making
- \$18 Million, 2.5 year program
- > 2,800 cars, trucks & buses
- 73 lane-miles
- 29 roadside equipment installations
- “Road Test” from 8/21/12 to 8/30/13



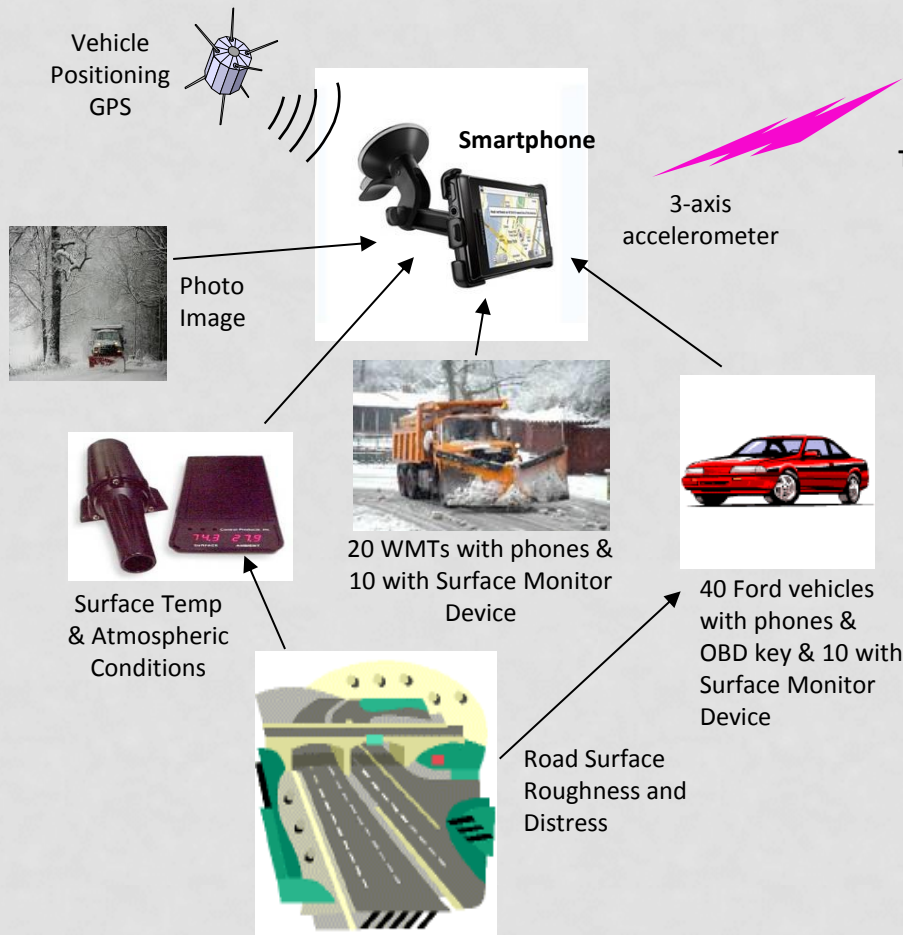
MDOT CONNECTED VEHICLE PROJECTS

- Integrated Mobile Observations (IMO)
- Vehicle-based Information and Data Acquisition System (VIDAS)
- Data Use Analysis and Processing (DUAP)
- Weather Responsive Traveler Information (Wx-TINFO)
- I-94 Truck Parking
- MDOT Smart Corridor Project

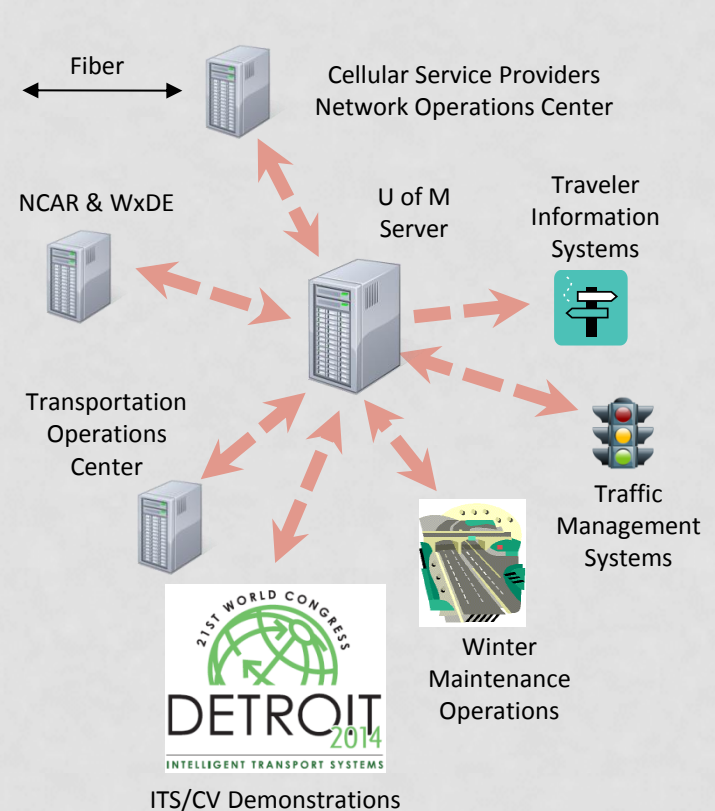


INTEGRATED MOBILE OBSERVATIONS

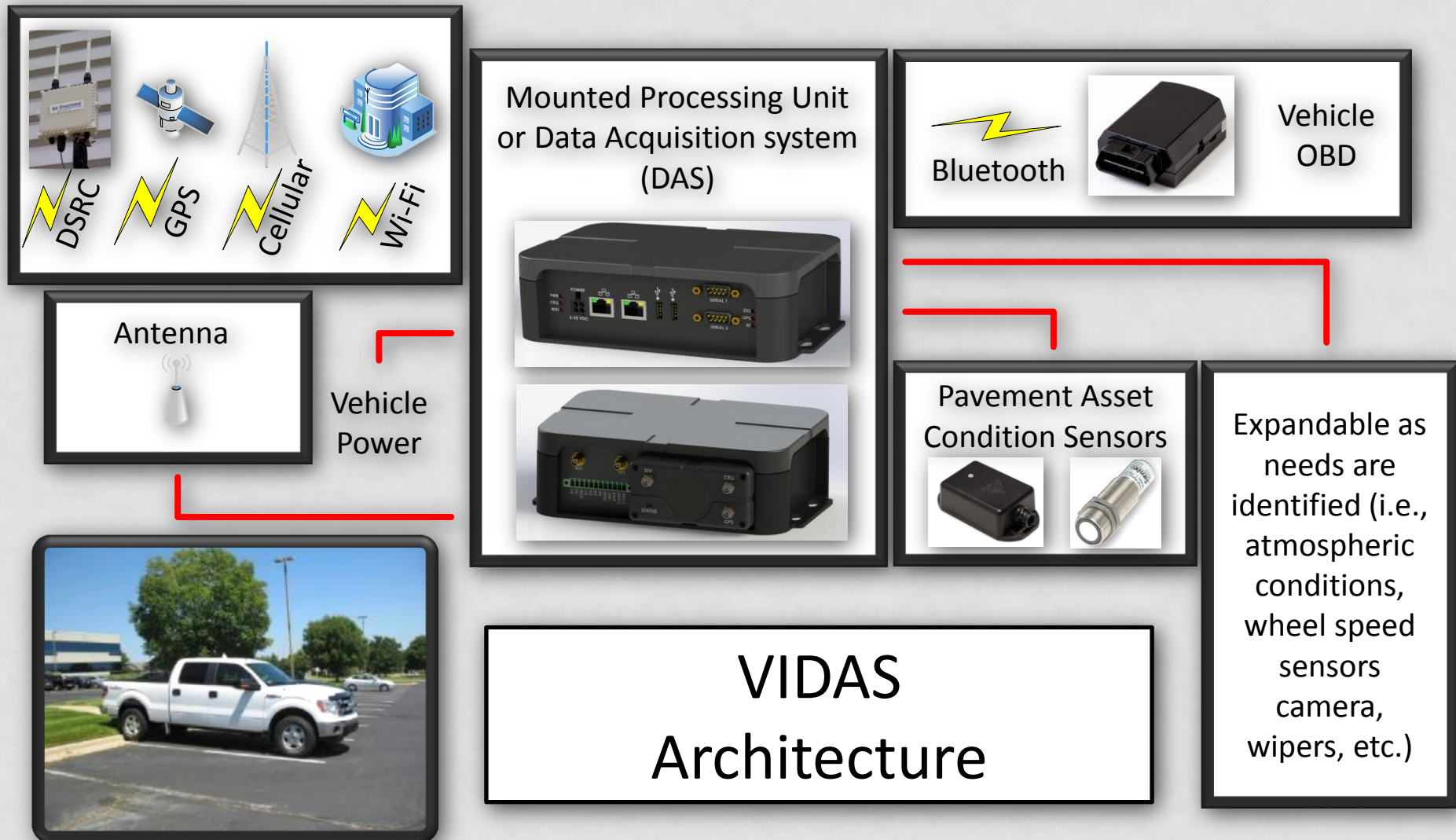
MDOT Vehicles - FHWA Data Collection



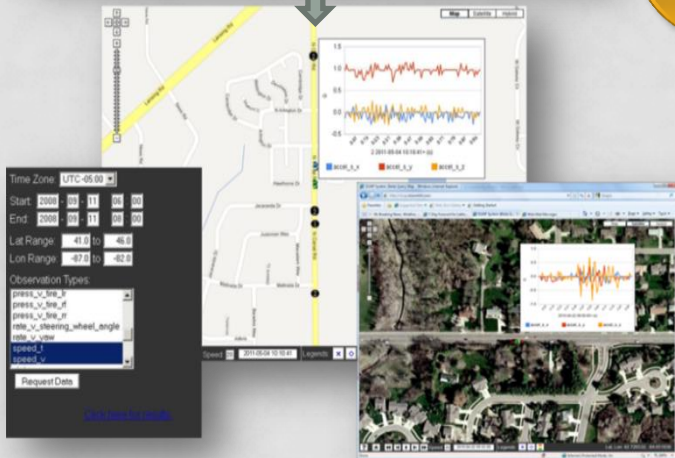
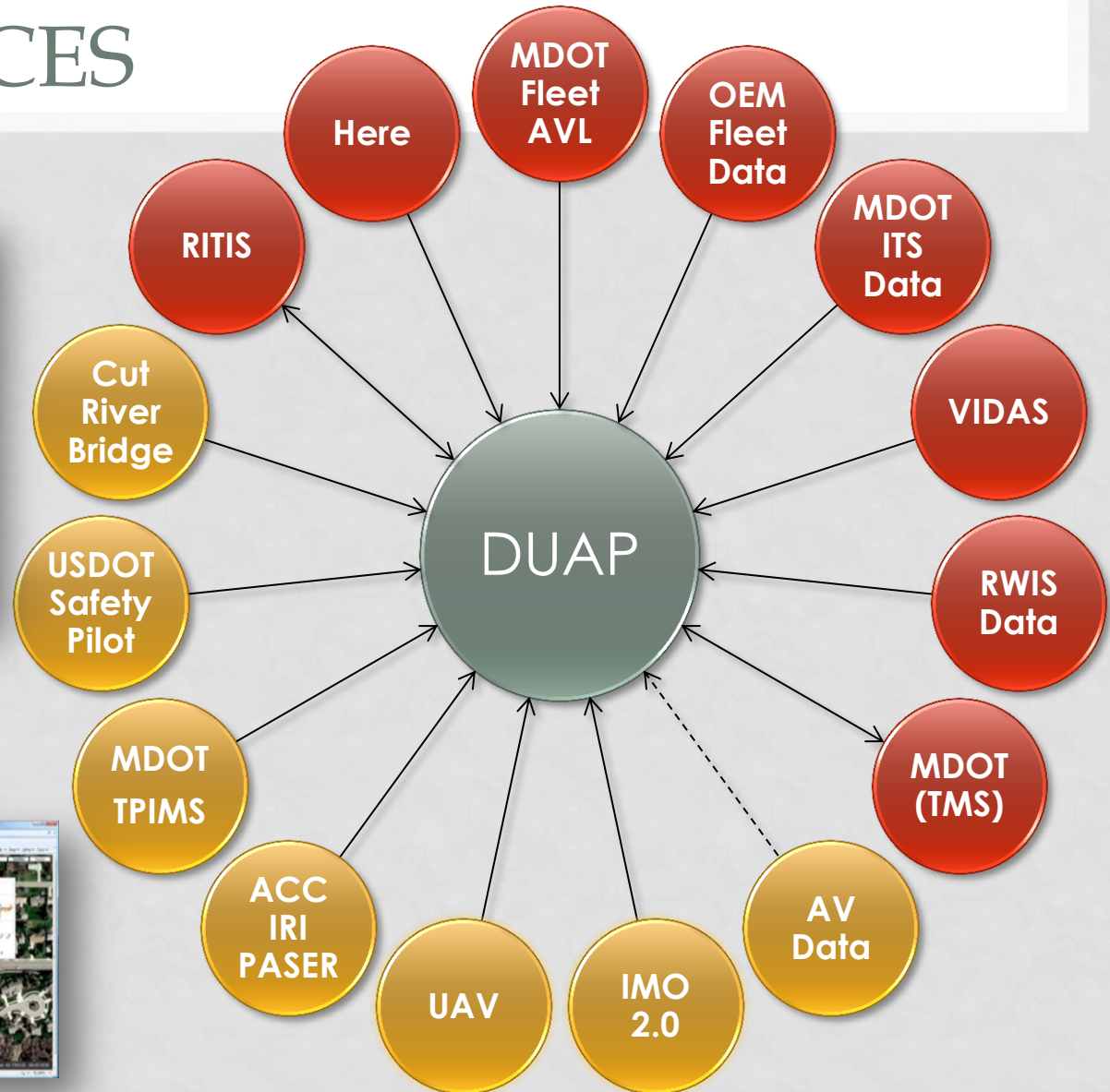
Data Users: University of Michigan, National Center for Atmospheric Research, MDOT MDSS & DUAP & TOCs/RITIS - UDC



VEHICLE-BASED INFO DATA ACQUISITION SYSTEM



MDOT DUAP PROJECT DATA SOURCES

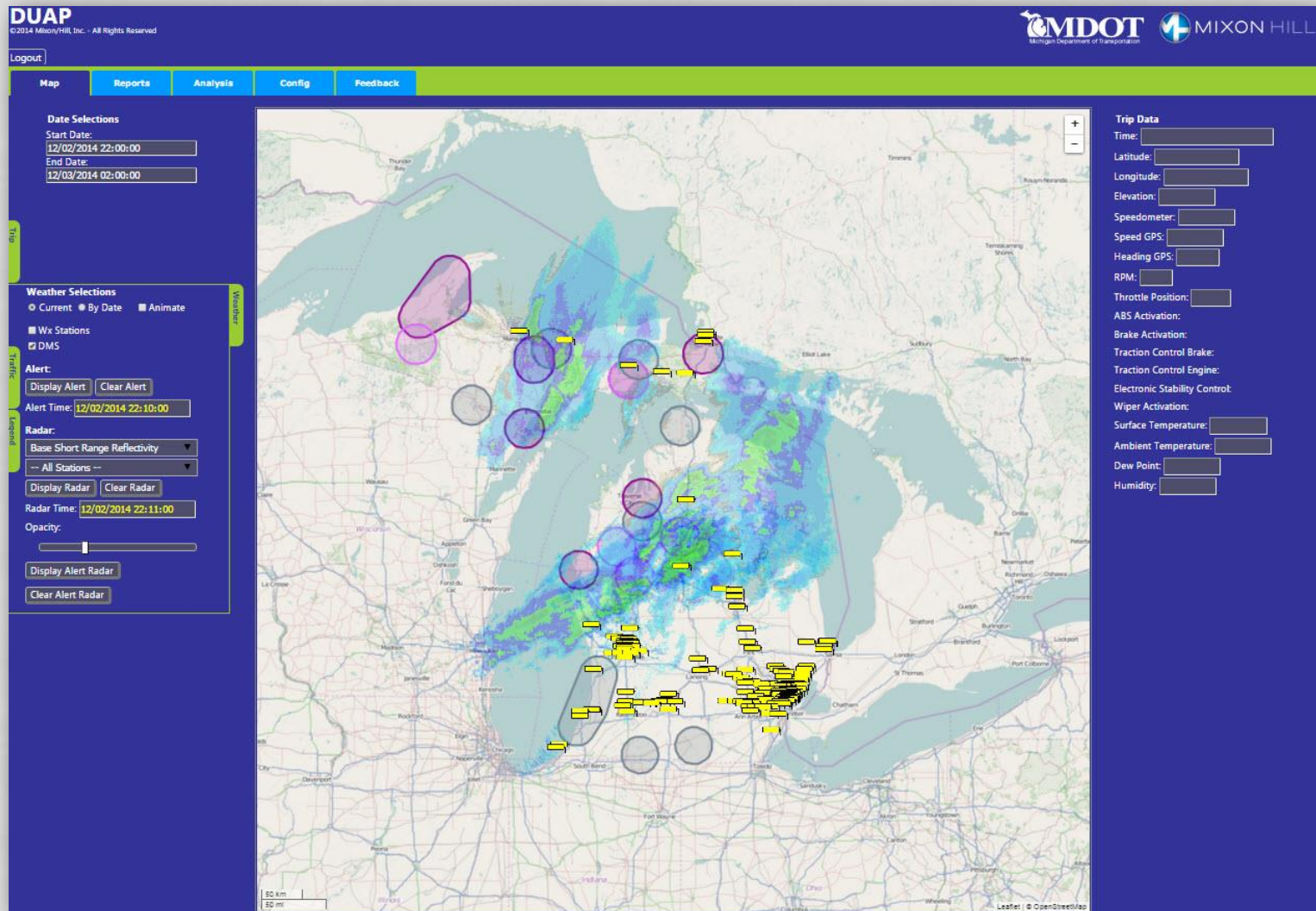


| Planning & Asset Management | Design | Construction | Maintenance | Operations |
|---|--|---|---|---|
| Potential Applications to Enhance Performance Management and Data Sharing | | | | |
| Pavement Conditions <ul style="list-style-type: none"> • IRI • PASER sufficiency ratings • Accelerometry | Pavement Conditions <ul style="list-style-type: none"> • Measure Rutting (traction control?) • Pavement Roughness vs. Fuel Consumption | Pavement Performance Correlation with environment <ul style="list-style-type: none"> • Long term pavement performance and cracking • Tracking pavement conditions for verification of reported vehicle damage • Cure time in environmental conditions • Trending data for cost/benefit analysis | Pavement Conditions <ul style="list-style-type: none"> • Friction • Ride Quality • Defect Type and Location • IRI PASER • Accelerometry | Pavement Conditions <ul style="list-style-type: none"> • Ice Forming • Tracking pavement conditions for verification of reported vehicle damage • Friction • Markings • Load Restrictions • Subsurface Impact |
| Traffic Planning <ul style="list-style-type: none"> • Volume Distribution • Volume Growth • Congestion Relief • Roadway System Planning | Intelligent Construction Probes for comprehensive As - builds <ul style="list-style-type: none"> • Determine actual subgrade compaction state • Environmental conditions at time of placement | Weather/Environment Information <ul style="list-style-type: none"> • Monitoring weather parameters • Frost depth • Best paving Conditions monitoring • Work Conditions Monitoring, i.e. Rain Delays • Greenhouse gas emissions | Weather <ul style="list-style-type: none"> • Winter Weather Maintenance <ul style="list-style-type: none"> • Response Times • Analyzing & Tracking weather systems • Winter maintenance activities • General Year-round Maintenance | Traffic Management <ul style="list-style-type: none"> • Volume • Occupancy • Speed • Travel Time • Seasonal Volume Changes • Route Guidance • Incident Notification • User Delay Cost |
| HPMS & TMS <ul style="list-style-type: none"> • Asset Location • Current Conditions • Systems Performance | Weather stations <ul style="list-style-type: none"> • Ongoing environmental monitoring • Impact on life of pavement • Rate of degradation of pavement • Winter weather maintenance | Work Zone <ul style="list-style-type: none"> • Traffic Conditions, i.e. speed, volume, queue lengths • Lane Departures • Worker Safety • Monitor when Active | Incident Management <ul style="list-style-type: none"> • Time of Occurrence • Pinpoint locations • Damage tracking on infrastructure • Incident Cause • Time to repair • Damage Log • High Incident Locations | Incident Management <ul style="list-style-type: none"> • Incident Report • First Responders Times • First Responders Guidance • Incident Locations • High Incident Locations • User Delay Cost |
| Reporting: <ul style="list-style-type: none"> • Volume • Speed • Occupancy • Classification • Travel Time • Origin & Destination Planning | Mechanistic Empirical Pavement Design <ul style="list-style-type: none"> • Weather impact • Fixed Station Placement | Site Monitoring <ul style="list-style-type: none"> • Real time site monitoring • Utility Location for Construction Equipment (DSRC), i.e. Overhead Power Lines • High precision as built mapping | Signals <ul style="list-style-type: none"> • Cost to Operate • Phase Analysis • Volume • Incident Analysis <ul style="list-style-type: none"> • Vehicle Location • Signal Phasing • Signal Delay | Weather Management <ul style="list-style-type: none"> • Treatment Status • Driving Conditions Status |
| Counts Path <ul style="list-style-type: none"> • Pedestrian • Bike | Traffic monitoring <ul style="list-style-type: none"> • Impact of traffic on pavement over time • Classification, Load cell | Contractor Management <ul style="list-style-type: none"> • Conditions of Temporary Pavement (Ride Quality) • Monitor Road/Lane Closures • Work Progress for Incentive Payments | Rest areas <ul style="list-style-type: none"> • Vehicles Pulling in • Time spent • Parking availability | |
| Truck Tracking <ul style="list-style-type: none"> • Freight • Light | | Topological Analysis <ul style="list-style-type: none"> • Channel Systems Migration • Land Erosions • Water levels | | |

DUAP APPLICATIONS

- Initial Applications:
 - Pavement:
 - Condition – Ride Quality, Surface Smoothness
 - Event – Pavement Defects & Severity – Potholes, Cracking
 - Weather:
 - Condition – Pavement Surface, Weather
 - Event – Pavement Advisory – Slippery, Icy, Snow Covered
 - Traffic:
 - Condition – Average Speed, SPaT
 - Event – Queues, Congestion, Incidents

WEATHER-RESPONSIVE TRAVELER INFORMATION



SAMPLE WX-TINFO MESSAGES

- White Out Conditions

WHITE OUT CONDITIONS
ON I-94
REDUCE SPEED

- Icy Roads

SLIPPERY ROADS
WB I-94
REDUCE SPEED

- Tornado Warning

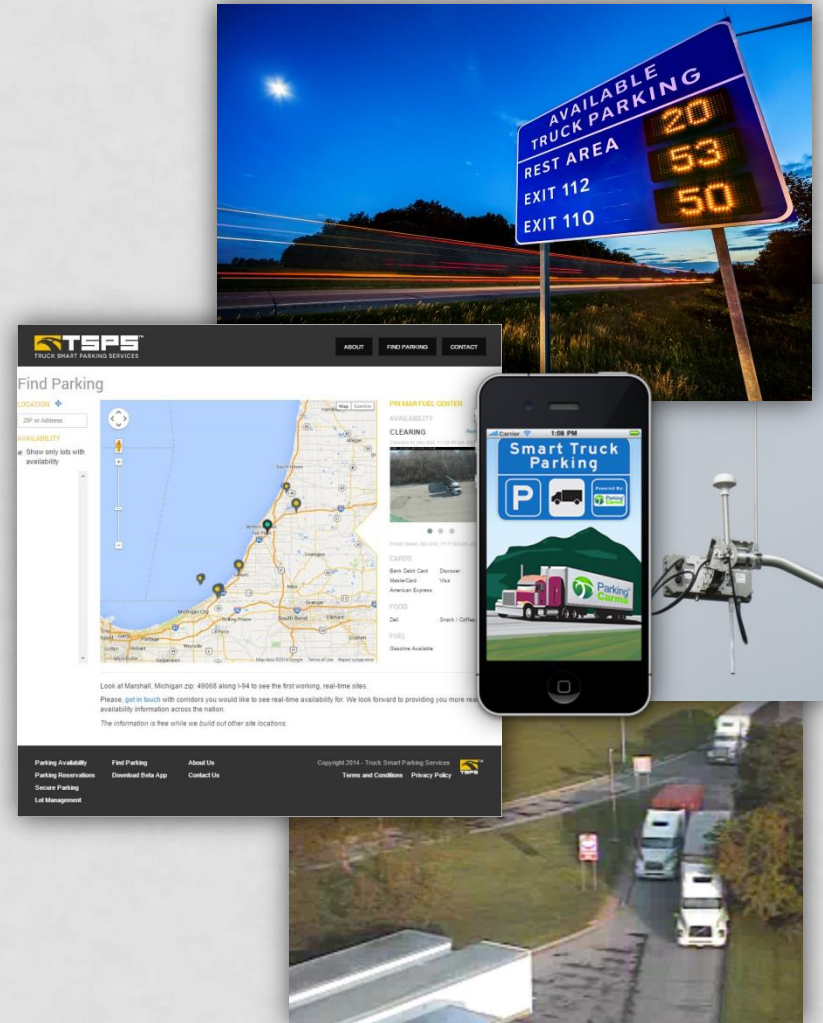
TORNADO WARNING
INGHAM COUNTY
8:00 – 10:00 AM

- Low Visibility

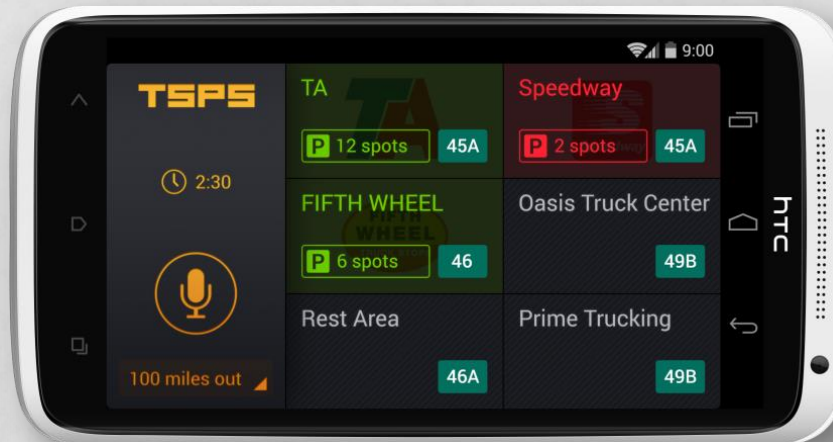
LOW VISIBILITY
NEXT 5 MI
REDUCE SPEED

TRUCK PARKING INFO & MANAGEMENT SYSTEM

- Provide Real Time Availability
- Improve Safety
- 5 Public Rest Areas
- 10 Private Truck Stops
- Counting ins/outs
- Dynamic Truck Parking Signs
- Mi Drive
- Truck Smart Parking Services
- Smartphone Application
- On-Board DSRC Equipment



TRUCK PARKING AVAILABILITY COMMUNICATION

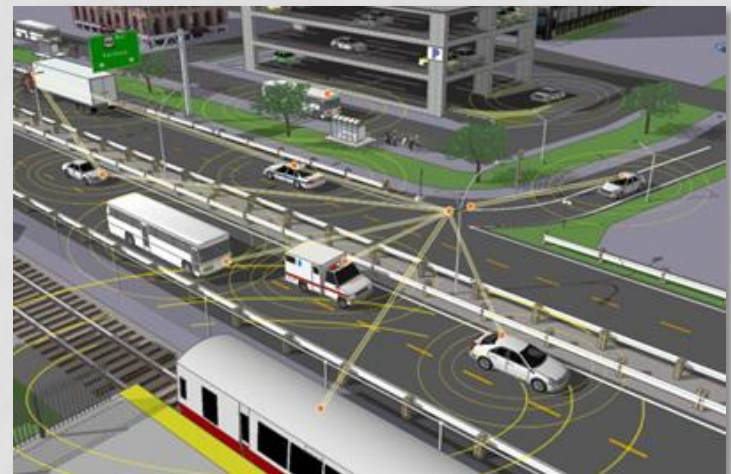


MDOT SMART CORRIDOR PROJECT

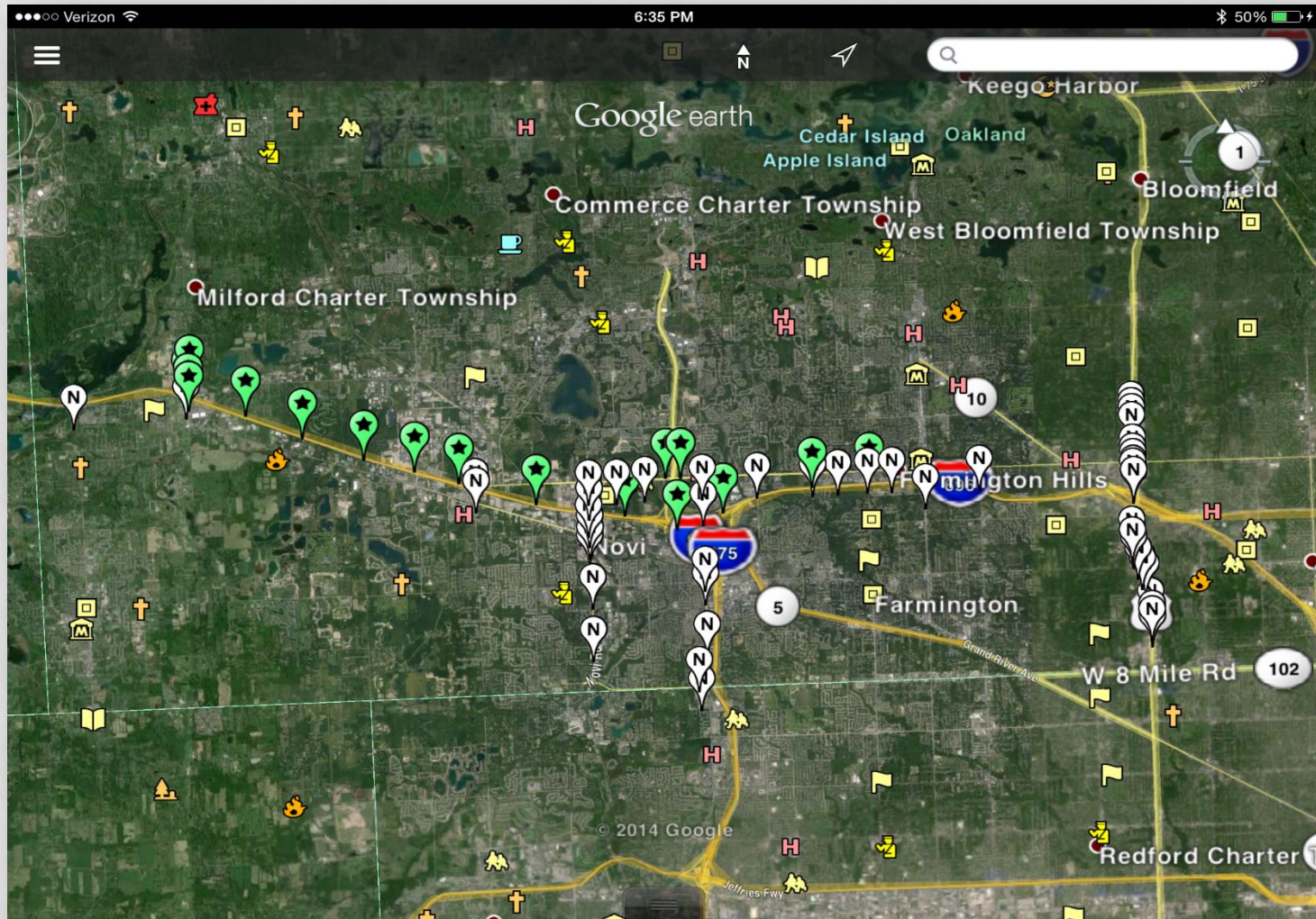


MDOT SMART CORRIDOR POTENTIAL CV APPLICATIONS

- Vehicle-to-Vehicle (V2V)
 - Emergency Electronic Brake Lights
 - Do Not Pass Warning
 - Forward Collision Warning
 - Intersection Movement Assist
 - Blind Spot/Lane Change Warning
 - Left Turn Assist
- Vehicle-to-Infrastructure (V2I)
 - Curve Speed Warning
 - Work Zone Speed Advisory
 - Spot Weather Impact
 - Road Hazard / Lane Closure Warning
 - Traffic Light Phase Information



MDOT SMART CORRIDOR INITIAL DEPLOYMENT



MDOT SMART CORRIDOR NEEDS

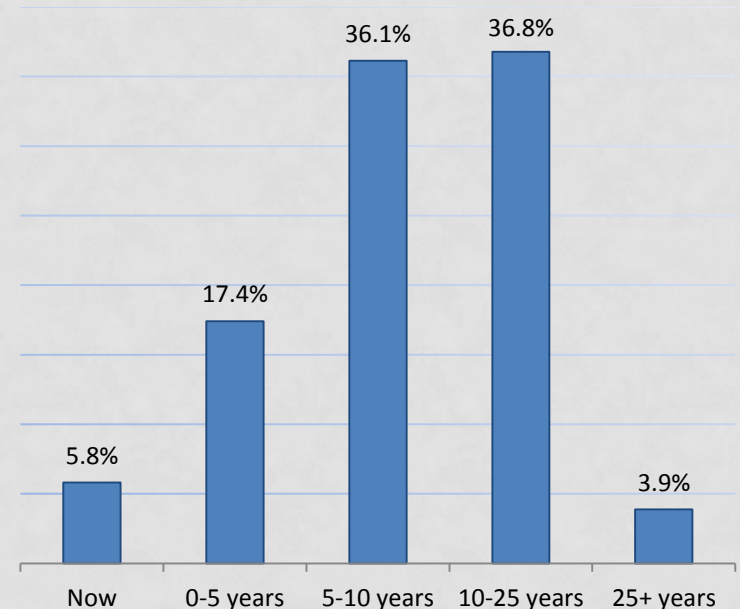
- Vehicles
- Application Development
- Communications (Backhaul)
- Security System
- Partnering (i.e., business model development)



Source: U.S. DOT

AUTONOMOUS VEHICLES

- Autonomous vehicles are coming
 - More than 95% believe within 25 years
 - More than half believe within 10 years
- Main barriers are institutional
 - Liability
 - Public Acceptance
- Stakeholders desire clear regulatory framework
 - Liability and insurance
 - Certification procedures and needs
- No consensus on best model for initial public deployment
 - Public transportation
 - Closed campus
 - Supporting infrastructure
 - Personal transportation
- Perceived Michigan strengths
 - Presence of auto & defense hub
 - Variable weather conditions
 - Wide range of road types



POTENTIAL MDOT SUPPORT OF AUTONOMOUS VEHICLES

- Road Use
- Road Surveying / Mapping
- Traffic Information
- Signing
- Pavement Marking
- Connected Vehicle “Connection”
- Traffic Signal Information



QUESTIONS

Collin Castle, P.E.

Connected Vehicle Technical Manager

MDOT ITS Program Office

(517) 636-0715

CastleC@michigan.gov

MDOT



Better.Faster.Cheaper.Safer.Smarter